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SCIENCE RESOURCES STUDIES HIGHLIGHTS

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Doctoral Awards in the Sciences Reached Record High in 1988

Highlights

- U.S. universities awarded 20,257 science and engineering doctorates in 1988, of which an all-time high of 16,067 were in science fields. Among the science fields, computer sciences, life sciences, and environmental sciences had record levels of doctoral awards.

- The growth in these fields contrasted with declines in psychology. Doctorate production in the mathematical sciences declined until 1985, but rallied through 1988. The social sciences remained stable.

- Foreign citizens accounted for over one-fourth of the science doctorates awarded in 1988, and in one science field, mathematics, they comprised one-half. Over the 1978-88 decade, increases in foreign participation compensated for the decline of U.S. citizens among science doctorate recipients.

- The number of white males earning doctorates in the sciences declined over the decade, reflecting widespread declines in doctorates in most fields. Computer sciences was the only major science field in which the number of white male doctorates increased. In contrast, engineering white male doctorates increased from 1983 to 1988 after an earlier period of decline.

- Women made considerable progress across the board in science fields at the doctoral level, increasing their representation from around one-fifth in 1978 to about one-third in 1988. They were the clear majority of recipients in psychology, earning 55 percent of the doctorates in 1988; women were least represented in the physical sciences, where they received 17 percent of the doctoral degrees.

- Minorities earning science doctorates increased from 639 in 1978 to 827 in 1988, but the number of science doctorates awarded to blacks declined over the decade. In physics and environmental sciences, minorities in general made no noticeable gains.

Trends in Science Doctorates

Students in the sciences earn almost one-half the doctorates awarded by U.S. universities; in 1988 they accounted for 48 percent of the 33,456 doctorates conferred in all fields. From 1978 to 1985 the number of science doctorates remained relatively stable, with annual degree production ranging from 14,600 to 15,200. Then, however, the number of science doctorates increased from 1986 to 1988, with the 16,067 science doctorates awarded in 1988 setting a new record.

The overall production of science doctorates masks significant changes by field (chart 1). Three fields hit record levels of doctorates: the number of degrees in computer sciences increased in 1988 to 514 doctorates, a 14-percent increase over 1987; the numbers of doctorates in the life sciences and in environmental (earth, atmospheric, and marine) sciences also hit record levels in 1988.

Mathematics rallied the last three years from a long decline to reach 749 in 1988. Even so, doctorates in mathematical sciences remained substantially below their 1972 record high of 1,281. Despite continued increases in the physical sciences over the last 8 years, awards have not yet equaled the peak that they reached in 1971. Doctorates in the social sciences and in psychology declined nearly every year after 1978 and 1983, respectively.

Prepared in the Science and Engineering Education Sector Studies Group, Division of Science Resources Studies

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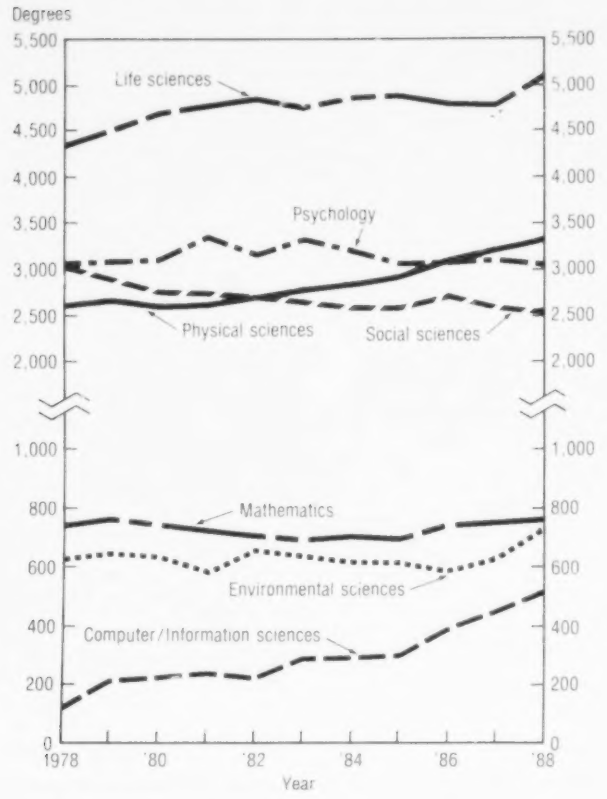
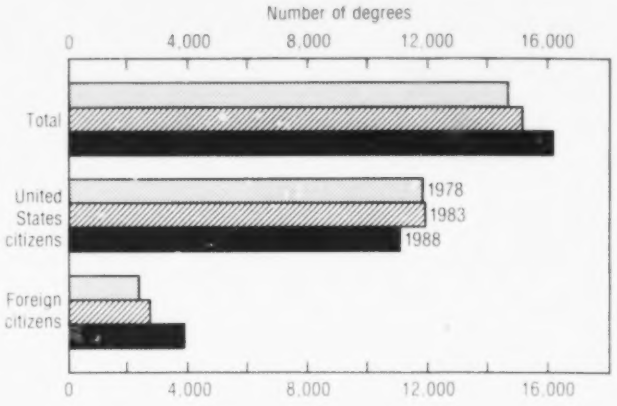
Chart 1. Science doctorate recipients by field



SOURCE: National Science Foundation, SRS

Chart 2. Science doctorates awarded by citizenship status



SOURCE: National Science Foundation, SRS

Characteristics of Science Doctorate Recipients

The characteristics of the recipients of science doctorates have changed considerably within the last decade in terms of citizenship, race, and sex. There has been greater participation of women and racial/ethnic minorities in the sciences than in engineering. Foreign participation continues to grow in both the sciences and engineering, but this growth has been more prominent in engineering than in the sciences.

Foreign Citizens

The role of foreign citizens among science doctorates has increased, especially in recent years. The number of foreign citizen doctorates grew in the sciences, rising from 2,383 to 3,844 from 1978 to 1988. During this decade, the participation of foreign citizens in science doctoral education grew slowly at first (less than 1 percent per year from 1977 until 1982), but then the rate of growth increased to between 6 percent and 9 percent annually.

As a result of the increase in foreign citizens and the overall decrease in U.S. citizens (chart 2), the share of science doctorates earned by citizens from foreign countries rose from 17 percent in 1978 to 26 percent in 1988.

The role foreign doctorates play in the sciences varies considerably by field. Two smaller science fields have the largest proportion of foreign doctorates: in 1988, foreigners accounted for 50 percent of the awards in mathematics and 43 percent of the degrees in computer sciences. At the opposite extreme, few foreigners participate in psychology (table 1).

About 5 percent of all science doctorate recipients were foreign citizens with permanent visas, giving them immigrant status with permission to remain in this country indefinitely; another 21 percent held temporary visas, permitting holders to stay for the specific purpose of pursuing academic study. The number of foreign science doctorates on permanent visas grew only slightly during the decade, from 645 in 1978 to 729 in 1988. On the other hand, those on temporary visas increased considerably, from 1,738 to 3,115.

Of the foreign doctorates with permanent visas, 14 percent were committed to work or study abroad after graduation, and of those with temporary visas, 38 percent had definite plans to leave the United States.[1] But only 23 percent of the foreign

[1]Plans are reported by doctorates who have made firm commitments, defined as a signed contract or other definite commitment at the time of graduation.

Table 1. Percent of doctorates awarded to foreign citizens in major science fields: 1988

Major fields	Percent of degrees awarded to foreign citizens
Mathematics	50
Computer sciences	43
Social sciences	34
Physical sciences	32
Environmental sciences	25
Life sciences	24
Psychology	5

SOURCE: National Science Foundation, SRS

doctorates in computer sciences who were on temporary visas planned to leave the United States.

U.S. Citizens

The number of U.S. citizens earning doctorates in science fields was stable from 1978 until 1981, but then declined 10 percent from 1981 to 1987. In 1988, the number of U.S. citizens increased slightly, but it is too early to tell if this is a new trend. This decline in U.S. citizens occurred in each major science field except computer sciences, in which large increases developed, and physical sciences, in which the level remained relatively stable.

The field of mathematics incurred the most significant loss in U.S. citizens earning doctorates. Their number was almost halved over the decade, dropping to 341. After 1982, however, increases in foreign citizens more than compensated for the declines in U.S. citizens; as a result, the total number of mathematics doctorates increased after 1985.

White Males

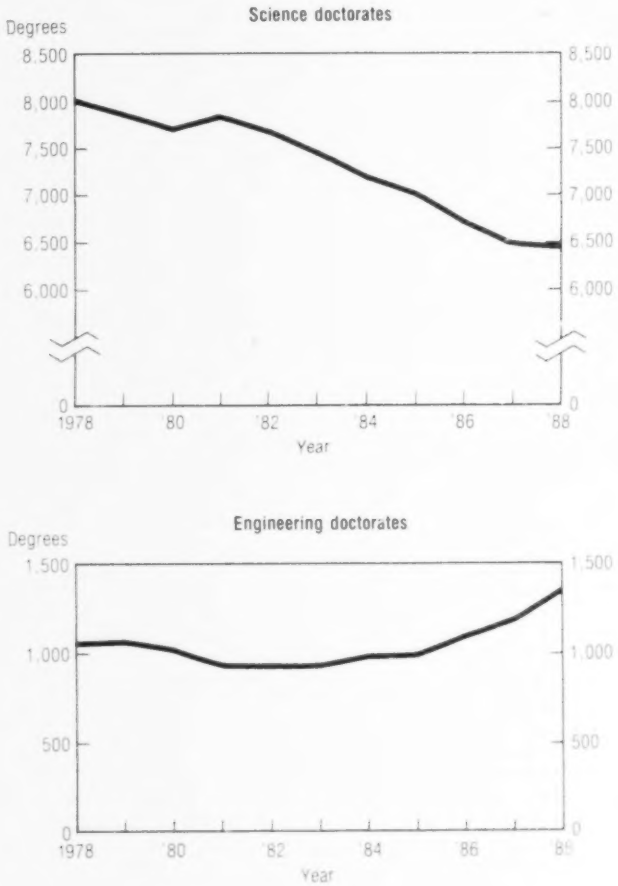
The drop in the number of U.S. citizens receiving science doctorates resulted primarily from the decline among white men. From 1978 to 1988, the number of white male doctorates declined 24 percent, from 8,001 to 6,473 (table 2). White men accounted for 68 percent of all science doctorates in 1978 compared to 58 percent in 1988. The decline in the number of white male doctorates in the sciences was continual throughout the decade. This trend reflected a general decline in white male doctorates in the broad science fields, with the exception of computer sciences. Unlike the sciences, however, engineering has had increases among white male doctorates since 1983, after an earlier period of decline (chart 3).

Table 2. Science doctorates awarded to U.S. citizens by sex and racial/ethnic background: 1978 and 1988

Racial/ethnic background and sex	1978	1988
Total	11,825	11,069
Total men	9,063	7,133
Total women	2,762	3,936
White non-Hispanic	10,410	10,432
Men	8,001	6,473
Women	2,409	3,559
Total minorities	639	827
Men	437	495
Women	202	332
Black non-Hispanic	269	212
Men	166	112
Women	103	100
Hispanic	141	276
Men	101	159
Women	40	117
Asian/Pacific Islander	212	300
Men	154	199
Women	58	101
Native American	19	39
Men	16	25
Women	3	14
Other and unknown	776	210
Men	625	165
Women	151	45

NOTE: Excludes foreign students, whether on temporary or permanent visas.
SOURCE: National Science Foundation, SRS.

Chart 3. Science and engineering doctorates awarded to white male U.S. citizens



SOURCE: National Science Foundation, SRS.

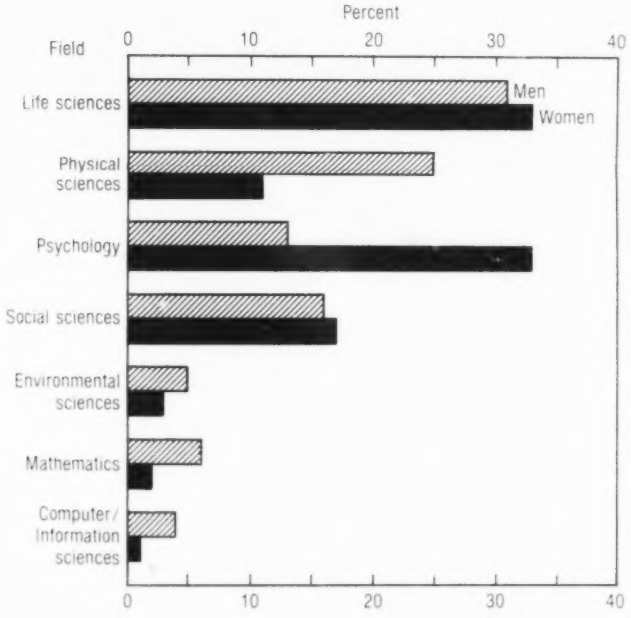
Women

The number of science doctorates awarded to female U.S. citizens increased considerably during the 1978-88 decade, rising from 2,762 to 3,936. While women showed increasing participation in the sciences, the participation of men was declining (table 2). As a result of these two trends, the proportion of female science doctorates among U.S. citizens rose from 23 percent to 36 percent during this period.

Not only were more women in general obtaining doctorates, but a larger proportion were choosing a science as their field of study. In 1978, 39 percent of all female doctorates earned their degrees in the sciences, increasing to 43 percent in 1988.

The number of female doctorates increased in almost every science field, with awards in many fields doubling or tripling during the decade. Women science doctorates were more likely than men, however, to have earned their degree in the field of psychology (where they became the majority in 1986), while men were more likely to have selected the physical sciences. The proportions of male and female science doctorates majoring in the life sciences and the social sciences, however, were similar (chart 4). The representation of women was lowest among mathematics, computer sciences, and physical science doctorates in 1988. Within the physical sciences, women had higher representation among doctorates in chemistry (21 percent) than in physics (10 percent).

Chart 4. Doctorate recipients in major science fields by sex: 1988



NOTE: Because of rounding, components may not add to totals.
SOURCE: National Science Foundation, SRS.

Racial/Ethnic Minorities

U.S. minorities overall increased their participation in the sciences at the doctorate level. They earned 827 science doctorates in 1988, compared with 639 in 1978 (table 2). Of the science doctorates awarded to U.S. citizens in 1988, minorities accounted for more than 7 percent of the total: 2.7 percent were awarded to Asians; 2.5 percent to Hispanics; 1.9 percent to blacks; and 0.4 percent to Native Americans. Except for blacks, all racial/ethnic groups had large increases in the number of science doctorates awarded from 1978 to 1988 (table 2). Over the decade, blacks lost considerable ground, with science doctorates declining 21 percent. For black men, there was a precipitous decline of 33 percent during this period; for black women, there was some progress until 1984, but then their numbers declined (26 percent by 1988).

Earlier reports have presented data showing that black science/engineering doctoral recipients, following a pattern characteristic of all fields, were less likely to receive financial support from their institutions (in the form of teaching/research assistantships or university fellowships, etc.) than were students of other racial/ethnic groups.[2] Analysis of 1987 data specifically for major science fields indicates that this was the case in terms of research assistantships, but not so in terms of university fellowships and other university-related support (table 3). In the physical sciences, blacks were less likely than whites to have been teaching assistants.

University assistantships have been related to a shorter average length of time to completion of the doctorate and are most likely related to persistence to Ph.D. completion.[3] In this important area of institutional support, the discrepancy between white and black doctorates was large in research assistantships, especially in the physical sciences.

[2]National Science Foundation, *Women and Minorities in Science and Engineering*, Report (NSF 88-301) (Washington, D.C., January 1988), pp. 46 and 222.

[3]Carrell Horton, *The Black Doctorate* (Washington, D.C.: University Press of America, 1988), p. 11. See also Susan Hill and Patricia White, "Black Participation in Doctoral Education," paper presented at the 14th National Conference on Blacks in Higher Education (Washington, D.C., April 1989).

Table 3. Percent of 1987 black and white doctorates receiving institutional support[1] during their graduate studies, by selected major science fields

Type of institutional support	Physical sciences		Life sciences		Social sciences	
	Blacks	Whites	Blacks	Whites	Blacks	Whites
Teaching assistantships	54	76	35	39	62	67
Research assistantships	23	60	35	50	26	42
Other[2]	23	23	27	29	38	45

[1]Indicates percent of students reporting each type of support. Doctoral students may have received more than one type of support during their graduate studies, so percents may add to more than 100.

[2]Includes university fellowships and other university-related forms of support.

SOURCE: National Science Foundation, SRS.

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This report is based on data resulting from the annual Survey of Earned Doctorates, a jointly sponsored survey of the National Science Foundation and four other Federal Government agencies and departments: National Endowment for the Humanities, National Institutes of Health, Department of Education, and Department of Agriculture. The survey is conducted annually by the National Research Council. Approximately 93 percent of recipients of the Ph.D. and similar doctorates, e.g., Ed. D., responded to the survey questionnaire in academic year 1987/88. The data base also includes some information on nonrespondents that was obtained from public sources; therefore, complete data are presented for field of doctorate and sex of recipient. Recipients of first-professional degrees (the M.D. degree, for example) are not included in this data base.

This report covers doctorates in science fields; similar information on engineering doctorates is also available. For additional information, please telephone Susan T. Hill at 202-634-4787.

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